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Impact of the e-prescribing system on the incidence and nature of drug-related problems in children in a Saudi hospital

Abstract

Objectives

To determine the impact of a computerised physician order entry (CPOE) system on the drug-related problems' (DRPs) incidence and characteristics in hospitalised children in a Saudi hospital, and to compare DRPs incidence pre-/post-CPOE implementation.

Methods

An observational study. DRPs were identified by pharmacists, reviewing children's (0-14 years) medical records on CPOE system, in paediatric wards and/or attending emergency department. DRPs preventability and severity were assessed.

Results

657 paediatric patients were included, with 235 (35.8%) experienced 328 DRPs, majority were preventable (99.7%,327). Difference in DRP incidence pre- and post-CPOE implementation (44.8% vs 35.8%, $p<0.01$) was significant.

Conclusion

The CPOE system has significantly reduced DRPs incidence in children in the study hospital.

Keywords: Computerised physician order entry; CPOE; Drug-related problems; DRPs; Children; Incidence; hospitalised paediatric patients.

Introduction

Computerised physician order entry (CPOE) has been recognised to reduce medication errors in adult and paediatric populations.[1-2]

Previous studies have investigated the incidence of and the risk factors for DRPs in children admitted to the paediatric wards and/or attended the emergency department (ED) at the King Abdulaziz Medical City-Jeddah hospital (KAMC-J), pre-CPOE implementation in 2011.[3-4] The studies showed that DRPs were common in children at KAMC-J. Dosing and drug choice problems were the most frequently reported DRPs. [3-4]

The use of CPOE at KAMC-J is relatively new and there is limited evidence on the impact of CPOE on the DRPs incidence in paediatric patients. Furthermore, there are limited comparable studies that have investigated DRPs in hospitalised children in Saudi Arabia following CPOE introduction. This study aimed to investigate the impact of the CPOE on DRPs incidence and characteristics in hospitalised children at KAMC-J, and to compare the DRPs incidence before and after CPOE-implementation.

Methods

An observational study was conducted on paediatric wards and ED at KAMC-J. Patient included were children aged 0-14 years admitted during the study period.

We used the same methodology that has been reported previously in the pre-CPOE implementation studies [3-4] and is summarised below.

Data were collected by pharmacists (excluding weekends/night shifts), over a four-month period (May–August 2016). Patients' medical records on CPOE, including electronic prescriptions were reviewed. Patients not on medication on admission or during their stay were excluded.

All identified DRPs were validated, assessed for severity and preventability and classified using the same assessment and classification tools used in the previous studies.[3-4]

The results of this study were compared with the findings of the previous studies conducted pre-CPOE implementation.[3-4]

Descriptive data analysis was performed. Data are presented as number, percentage and median (interquartile range, IQR), unless otherwise specified. Chi-squared test, Kruskal–Wallis rank and Wilcoxon rank sum (Mann–Whitney U test) were used as appropriate. Statistical significance was considered at $p<0.05$.

DRP incidence was defined as; number of patients with at least one DRP divided by total number of patients in the study cohort, or by the number of patients in each ward, and multiplied by 100. The incidence was calculated with 95% confidence interval (CI).

This study was approved by the Research Committee at King Abdullah International Medical Research Centre-Western Region (RJ15/043/J) in 2015.

Results

A total of 657 patients (median age 1.5 years, IQR 2-6 years) were included, 58.9% (387/657) were male. Overall, 328 confirmed DRPs were identified for 235 (35.8%) children, (Table 1). There was a significant difference in DRPs incidence between wards (p=0.031). The highest incidence was reported from ED (52.2%, 95%CI 41.4 – 62.9).

Dosing problems (64.9%,213/328) were the most frequently reported DRPs, followed by drug choice problems (32.9%,108/328). This was the case in each study area, [supplementary table 1]. The majority (74.2%,274/369) of reported causes of DRPS in each area were related to drug or dose selection. [Supplementary table 2]

Majority of DRPs (95.1%,312/328) was found to be moderate in severity and 4.6% (15/328) were assessed as minor (Table 1). Only one DRP (0.3%,1/328) from ED was assessed as severe. This

was “inappropriate drug selection” problem; related to a patient prescribed ‘amoxicillin/enzyme inhibitor’ despite being documented as penicillin allergic.

Almost all identified DRPs were deemed preventable (99.7%,327/328), (Table 1). Only one DRP was deemed not preventable, which was a side effect problem related to a high insulin dose which resulted in patient becoming hypoglycaemic.

Significant difference in the DRP incidence was found between pre- and post-CPOE implementation (44.8% vs 35.8%, $p<0.01$), (Table 2).

Almost all identified DRPs post-CPOE implementation (99.7%) were found to be preventable compared to 92.3% of DRPs in the pre-implementation studies, $p<0.001$. There was a significant difference in severity between the pre-and post-studies, $p<0.01$. In pre-CPOE implementation, 69.0% (214/310) of DRPs were assessed as minor, while 95.1% (312/328) were moderate in severity post-CPOE. Drug choice problems were more frequent in the post-CPOE implementation (32.9% (108/328) vs 10.3% (32/310), while dosing problems were more frequent in pre-CPOE implementation study (72.6% (225/310) vs 64.9% (213/328)). Interaction problems were more frequent in pre-CPOE study (5.5% (17/310) vs 0.6% (2/328), $p<0.001$). [Supplementary table 3]

Discussion

Five years following CPOE implementation, this study showed that there was a reduction in DRPs occurrence. This is likely to be attributed to the CPOE, as it is the only change that has been made to the prescribing process at KAMC-J.

To our knowledge, this is the first study to report on the DRPs incidence post-CPOE system implementation in a Saudi hospital, and to compare the incidence with the findings reported pre-CPOE implementation. Also, to avoid variation in methodology and to be able to compare the pre- and post-CPOE implementation findings, this study adopted the same methodology and DRP classification that have been used in the pre-CPOE implementation studies.[3-4] However, certain

limitations must be considered when interpreting our results. The study was conducted at one institution; hence drawing on a single institution's experience. The use of off-label/unlicensed medications was not considered in the analysis. Weekend/night shifts were excluded from data collection. Potential risk factors that might be confounders for DRPs occurrence were not investigated.

Frequency of severe DRPs was lower post-CPOE, which suggests that CPOE contributed to the reduction of more severe DRPs. This has been seen in previous CPOE studies conducted in children.[5] Significant difference between dosing and interaction problems frequencies pre- and post-CPOE highlights the impact of CPOE in minimising such medication problems. Also, the reduction in the interaction problems frequency post-CPOE might be explained by the presence of "interaction alert" function built within the system. This in line with previous studies.[5]

Though there has been a reduction in the DRPs incidence in this study, the reported incidence does show that DRPs in children at KAMC-J remain common. This might be attributed to the fact that different drug dosing references are still being used throughout KAMC-J.[6-10] In addition, the computerised clinical decision support (CCDS) built into CPOE is based on adult dosing formulary which might have contributed to the DRP occurrence.

The lack of a specific paediatric dosing guidance built into CPOE might explain the persistence of the high number of dosing and drug choice problems in the current study. Therefore, incorporating a more paediatric specific CCDS into CPOE system may help in more reduction of potential DRPs leading to further improvement in patient safety.

Other strategies to reduce DRPs frequency in hospitalised children and minimize their harmful consequences should also be considered, e.g. using standardized dose bands of antibiotics in children across the hospital.

Conclusion

This observational study showed that the CPOE system might have resulted in the reduction of DRPs incidence in hospitalised children at KAMC-J. Majority of identified DRPs were dosing and drug choice problems, similar to pre-CPOE implementation findings, suggesting that incorporating a more paediatric specific CCSD into CPOE is necessary to further reduce these problems and improve the care provided to children.

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165 Table 1 Frequency and incidence of DRP in each study ward and overall, post-CPOE implementation

	NICU (n=88)*	PICU (n=57)*	Medical (n=204)*	Surgical (n=218)*	ED (n=90)*	Overall (n=657)
Number of DRPs (%)	35 (10.7)	40 (12.2)	106 (32.3)	86 (26.2)	61 (18.6)	328 (100)
Number of patients by gender, n (%)						
Male	56 (63.6)	34 (59.6)	118 (57.8)	126 (57.8)	53 (58.9)	387 (58.9)
Female	32 (36.4)	23 (40.4)	86 (42.2)	92 (42.2)	37 (41.1)	270 (41.1)
Number of patients with DRP (%)	26 (29.5)	22 (38.6)	78 (38.2)	62 (28.4)	47 (52.2)	235 (35.8)
Age of children (in years) with DRPs; median (IQR)	0.1 (0.04 -0.1)	0.3 (0.2 – 1.3)	2 (0.4 – 7)	4 (2 – 8)	1.6 (0.3 – 5)	1.6 (0.2 – 6)
DRP incidence by gender; n (%)						
Male	17 (30.4)	13 (38.2)	42 (35.6)	35 (27.8)	28 (52.8)	135 (34.9)
Female	9 (28.1)	9 (39.1)	36 (41.9)	27 (29.3)	19 (51.4)	100 (37.0)
DRPs incidence; % (95% CI)	29.5 (20.3 – 40.2)	38.6 (26.0 – 52.4)	38.2 (31.5 – 45.3)	28.4 (22.5 – 34.9)	52.2 (41.4 – 62.9)	35.8 (32.1 – 39.6)
Severity						
Minor	-	-	4 (3.8)	9 (10.5)	2 (3.3)	15 (4.6)
Moderate	35 (100)	40 (100)	102 (96.2)	77 (89.5)	58 (95.1)	312 (95.1)
Severe	-	-	-	-	1 (1.6)	1 (0.3)
Preventability; n (%)						
Preventable	35 (100)	40 (100)	106 (100)	85 (98.8)	61 (100)	327 (99.7)
Not preventable	-	-	-	1 (1.2)	-	1 (0.3)

CPOE: Computerised Physician Order Entry; IQR: interquartile range; DRPs: Drug Related Problems; ED: Emergency Department; PICU: Paediatric Intensive Care Unit; NICU=Neonatal Intensive Care Unit; *n: total number of patients

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Table 2 Comparison of frequency and characteristics of identified DRPs

	Pre-CPOE n (%)	**Post-CPOE n (%)**	***P* value**
No. of DRPs	310	328	<0.01
No. of patients with DRPs; n (%)[a]	227 (44.8)	235 (35.8)	
No. of patients with DRPs by gender; n (%)			0.760
Female	94 (18.5)	100 (15.2)	
Male	133 (26.2)	135 (20.5)	
DRP incidence; % (95% CI)	44.8 (40.2 – 49.0)	35.8 (32.1 – 39.5)	<0.01
Severity of DRPs; n (%)			<0.001
Minor	214 (69.0)	15 (4.6)	
Moderate	92 (29.7)	312 (95.1)	
Severe	4 (1.3)	1 (0.3)	
Preventability; n (%)			<0.001
Preventable	286 (92.3)	327 (99.7)	
Not preventable	24 (7.7)	1 (0.3)	

[a]% calculated out of the total number of patients in each study cohort; pre-implementation=507; post-implementation = 657; CPOE: Computerised Physician Order Entry; DRPs: Drug-related problems